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AQUATIC MACROINVERTEBRATE AND HABITAT SURVEY

THE FLATWILLOW CREEK SYSTEM OF FERGUS COUNTY, MONTANA

prepared for

Landowners of the Flatwillow Creek drainage
and
the Montana Department of Environmental Quality

by

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INTRODUCTION

Benthic macroinvertebrate populations are known to be key indicators of stream ecosystem health (Hynes 1960). Life spans for some of these creatures are as long as three years, and their complex life cycles and limited mobility mean that there is ample time and opportunity for the community to respond to cumulative effects of environmental perturbations. The analysis of macroinvertebrate communities can thus be related to a stream's biological health, or integrity, defined by Karr and Dudley (1981) as "the capability of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition, diversity and functional organization comparable to that of natural habitat of the region."

The multimetric approach to bioassessment using benthic macroinvertebrates uses attributes of the assemblage in an integrated way to reflect overall biotic condition. Community attributes which can contribute meaningfully to bioassessment include assemblage structure, sensitivity of community members to stress or pollution, and functional traits. Each metric component contributes an independent measure of the biotic integrity of a stream site; combining components into an overall score reduces variance and increases precision of the assessment. (Fore et al. 1996).

This report presents data collected in 1997 from Flatwillow Creek and its North and South Forks, using a multimetric methodology which is an adaptation of the U.S. EPA's Rapid Bioassessment Protocols (RBP) (Plafkin et al. 1989). Ten macroinvertebrate samples were collected, and habitat evaluated, in order to establish baseline conditions in the area. Analysis will facilitate comparison with future data collected at the same sites.

METHODS

Benthic macroinvertebrate sampling was performed by personnel of the Montana Department of Environmental Quality (DEQ) on June 26 and 27 and August 13 and 14, 1997. The traveling kick-net method described by Bukantis (1997) was utilized. Seven riffled reaches were sampled and samples were replicated at three sites, yielding ten macroinvertebrate samples, which are numbered, dated and described as follows:

SITE 1: South Fork Flatwillow Creek, 8/13/97, Uppermost site

SITE 2: South Fork Flatwillow Creek, 8/14/97, Middle reach. Replicates 1.2 and 1.2.

SITE 3: South Fork Flatwillow Creek, 8/14/97, Above mouth. Replicates 2.1 and 2.2.

SITE 4: North Fork Flatwillow Creek, 8/14/97, Above mouth.

SITE 5: North Fork Flatwillow Creek, 6/26/97, Below Havalla's bridge.

SITE 6: North Fork Flatwillow Creek, 8/14/97, Below NBar boundary. Replicates 4.1 and 4.2.

SITE 7: Lower Flatwillow Creek, 6/27/97, Across from test center.

Habitat parameters were scored using a DEQ-modified version of the U.S. EPA's Rapid Bioassessment Protocols.

In the laboratory, the RBP III sorting method was used to obtain subsamples of 300 (+/- 10%) organisms from each of the ten samples. The organisms were identified to taxonomic levels appropriate to RBP III analysis, usually genus or species. Guidelines for

taxonomic work provided by Bukantis (1997) were generally followed. Community structure, function and sensitivity to impact were characterized for each subsample using the battery of eight metrics recommended by DEQ for streams in the Montana Valleys and Foothill Prairies Ecoregion.

Two approaches were employed in the analysis of data for this report. The first approach relies on an ecoregional reference and scoring criteria; metric values were compared to the established Montana Valleys and Foothill Prairies Ecoregion reference values (Table 1). The ecoregional reference approach allows comparison of sites sampled in the Flatwillow Creek drainage to streams elsewhere in the ecoregion.

In the second analysis, an internal reference was established for the Flatwillow Creek drainage; a reference value for each metric was determined for all study sites based on the performance of that metric at all sites. The best value for each metric from any site in the Flatwillow Creek drainage was chosen as the point of comparison, or reference value, for each metric used. Total metric scores were obtained by summing scores for all metrics, and an impairment classification and a use support category for each site was derived from the total score.

RESULTS AND DISCUSSION

Habitat assessment

Figure 1. Habitat assessment scores. Flatwillow Creek drainage. 1997.

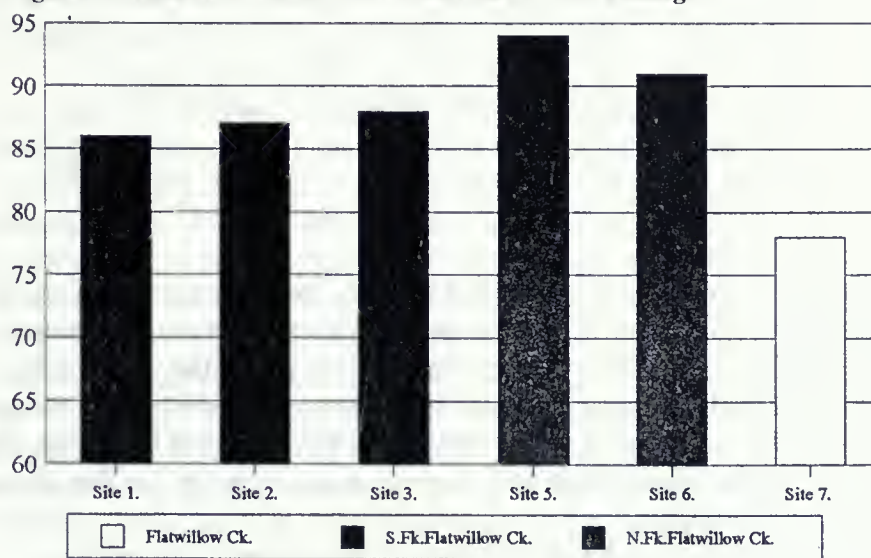


Figure 1 compares total habitat assessment scores for Flatwillow Creek drainage sites evaluated. Table 6 gives results of all habitat parameters for these sites. Habitat conditions were not evaluated at Site 4 on the North Fork.

Conditions were perceived to be optimal at all sites studied, except for the lower Flatwillow Creek site (across from test center), which was sub-optimal. Substrate

embeddedness and sediment deposition impacts were noted at this site, and decreased bank stability and compromised riparian width along one bank contributed to the lower score.

Generally, the North Fork of Flatwillow Creek received higher habitat scores than the South Fork. The North Fork Flatwillow Creek site below Havalla's bridge received the highest total habitat score of the sites evaluated. All habitat parameters at this site were rated optimal,

except for substrate diversity, which was considered sub-optimal. Sediment deposition lowered scores at all sites, but particularly at the middle South Fork site and at the North Fork site below the upper NBar boundary where the parameter was rated marginal.

Macroinvertebrate communities

Macroinvertebrate taxa lists, metric results and other information for each sample are given in the Appendix.

The percent similarity of communities between replicated samples was 63% for replicates taken in the middle reach of the South Fork, 55% for those taken in the South Fork above the mouth, and 59% for those taken in the North Fork below the NBar boundary. Percent similarities of communities between sites is displayed in Figure 2. For replicated samples, the percent similarity calculations are based on combined replicates.

Figure 2. Percent similarity between sites. Flatwillow Creek drainage, 1997.

	SITE 1	SITE 2	SITE 3	SITE 4	SITE 5	SITE 6
SITE 2	31					
SITE 3	30	72				
SITE 4	24	80	65			
SITE 5	21	27	26	27		
SITE 6	52	56	55	44	46	
SITE 7	23	47	36	47	48	36

Macroinvertebrate communities at two of the South Fork sites were quite similar to each other and to the community at the North Fork site near the mouth. All three communities were sampled in August. The June-sampled community at the North Fork site below Havalla's bridge and the August-sampled community at the uppermost South Fork site are each distinctive, though each is moderately similar to the community at the North Fork site below the NBar boundary. The community there shares various taxa and abundances with all other sites except for the Flatwillow Creek site, regardless of the month of sampling.

At the lower Flatwillow Creek site, which was sampled in June, the macroinvertebrate community was dominated by the ubiquitous mayfly *Baetis tricaudatus*, *Tricorythodes minutus*, and the filtering caddisflies *Hydropsyche* sp. and *Brachycentrus occidentalis*. Together, these four insects comprised 63% of the sampled assemblage; all are moderately tolerant of sediment and organic pollution. Their dominance, along with the elevated biotic index score (3.99), absence of stoneflies, and relatively low number of EPT taxa (11) strongly suggests a combination of mildly impaired habitat from sediment deposition as well as some organic and/or nutrient impacts to

water quality.

Most sites on the North Fork of Flatwillow Creek had more sensitive communities than other sites in the drainage, but evidence of slight organic and/or nutrient impacts to water quality were evident nonetheless. In addition, a relatively low abundance of cold stenothermic organisms, represented by few taxa was a finding at all sites on the North Fork. Field forms indicate that temperatures measured at these sites averaged nearly 20° C, nearly 5.5° higher than temperatures measured in the South Fork. Physid snails, generally indicative of warm water conditions, were abundant at two North Fork sites.

In June, at the North Fork site below Havalla's bridge, a quite sensitive community (biotic index = 3.05) was present, but overall taxa richness was low (24), and the two dominant taxa, *Baetis tricaudatus* (34% of the sampled assemblage) and *Brachycentrus occidentalis* (21%) suggest water quality impairment. Organic or nutrient inputs and/or thermal impact are possible sources of impairment.

In August, the snail *Physella* sp. dominated the benthic assemblage (28%) at the North Fork site above the mouth. The biotic index score here was 5.55, the highest value obtained for any site in the Flatwillow Creek drainage, indicating a quite tolerant community. Organic and/or nutrient impacts to water quality are strongly suggested by these data.

Organic inputs are particularly evident at the North Fork site below the NBar boundary, where the blackfly *Simulium* sp. and *Baetis tricaudatus* were abundant. Large numbers of filter-feeders, including *Brachycentrus occidentalis* and *Hydropsyche* sp. strengthen the suggestion; filtering organisms made up 29% of the sampled assemblages. Diversity of instream habitat seemed to be good, however, since taxa richness and EPT richness were both high here, and seven predatory taxa, including the stoneflies *Hesperoperla pacifica* and *Skwala* sp., and substantial numbers of the mayfly *Drunella spinifera* were able to be maintained.

Generally, communities in the South Fork were characterized by a low number of stonefly taxa - only five taxa were collected in the five replicates gathered, and the presence of a few more cold stenothermic taxa in somewhat greater abundance than in the North Fork. Natural and man-made ponds may contribute to the abundance of filter-feeding organisms in the South Fork, which averaged 33% of the sampled assemblages and were especially abundant in the middle and lower reaches. At the uppermost site, cold stenothermic organisms comprised 17% of the community; the measured temperature at this site was 13.6° C. No measurements were made at the other two South Fork sites, but abundant physid snails and the presence of the warmwater mayfly taxa *Caenis* sp. suggest that water temperature may limit the benthic community in the South Fork.

In August, the benthic community at the uppermost South Fork site was moderately sensitive to pollution (biotic index = 3.38), but a skewed taxonomic composition suggests mildly impaired biotic health. Diptera made up 53% of the community, and midges were particularly abundant. The dominant taxon was the midge *Pagastia* sp.

The middle reach of the South Fork of Flatwillow Creek supported a community dominated by filter-feeders and creatures tolerant of organic and/or nutrient pollution, including *Simulium* sp. and *Baetis tricaudatus*, as well as *Hydropsyche* sp. and *Physella* sp. Biotic index scores were moderately high (mean score = 4.79). Instream habitat may also be impaired slightly here, since EPT richness is mildly depressed compared to the other sites studied. The impairment may be at least partly due to sediment deposition.

Above the mouth, the South Fork of Flatwillow Creek also had high biotic index scores (mean = 4.98), indicating a pollution tolerant community. A community typical of slight-to-moderately impaired sites in valley and foothill streams dominates this site: abundant *Baetis tricaudatus*, *Hydropsyche* sp. and *Simulium* sp. In addition, large numbers of *Physella* sp. suggest organic impacts to water quality, and the elmid beetles *Dubiraphia* sp. and *Optioservus* sp., which comprise 11% of the sampled assemblage, suggest that sediment deposition alters the instream habitat.

Bioassessment

Figure 3 compares bioassessment scores for Flatwillow Creek drainage sites when computations are based on comparison with the Montana Valley and Foothill Prairie ecoregion reference (Bukantis 1997). Scores of individual metrics for all replicates are given in Table 4. Table 1 shows the criteria for assignment of metric scores.

Compared to streams in the ecoregion, the sites studied here show little, if any, impairment to biotic health. North Fork sites are unimpaired, and South Fork sites are slightly impaired. The single site on the main stem of Flatwillow Creek is slightly impaired. Good to excellent taxa richness, which, in this case seems to indicate a high degree of complexity of substrate and flow combinations, contributes to the high overall bioassessment scores. Scores are also influenced by good taxonomic balance; in each sampled community, no single taxon overwhelmingly dominates. That is, there are no "blooms" of highly tolerant or "weedy" animals. Still, relatively high biotic index scores at two of three sites on the South Fork and at a single site on the North Fork, as well as peculiarities of the taxonomic composition of the sampled assemblages, described earlier, together seem to signify that the health of the

Figure 3. Bioassessment scores, compared to ecoregional reference.

Flatwillow Creek drainage. 1997.

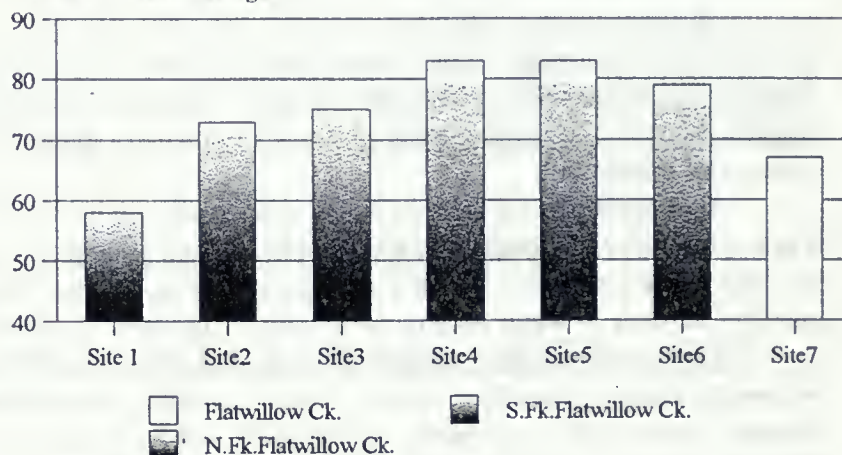
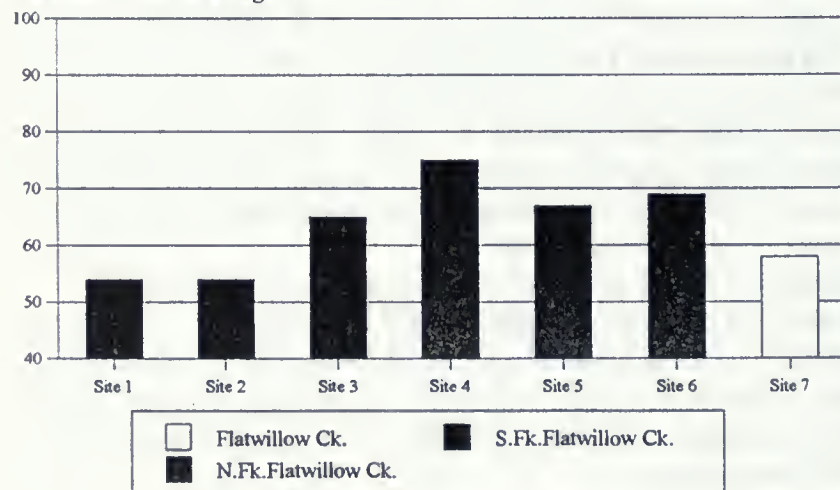


Figure 4. Bioassessment scores, compared to internal reference.

Flatwillow Creek drainage. 1997



benthic communities at these sites are impacted in some way, either naturally or anthropogenically.

Crafting an internal reference, and comparing metric scores to the new reference values allows Flatwillow Creek sites to be compared with the actual performance of metrics at study sites within the drainage, which, in this case, proves to be a more sensitive analysis. Figure 4 shows the bioassessment scores of the studied sites when computations are based on comparison to this internal reference. Table 3 shows the reference values and the scoring criteria for this analysis and Table 5 gives metric values and scores for all replicates. In this analysis, all sites show some degree of impairment, though it is categorized as slight in all cases. Poor biotic index scores at four of the seven sites, compared to the actual potential score in the drainage, are more apparent.

Figure 5. Habitat vs. bioassessment scores.

Flatwillow Creek drainage, 1997.

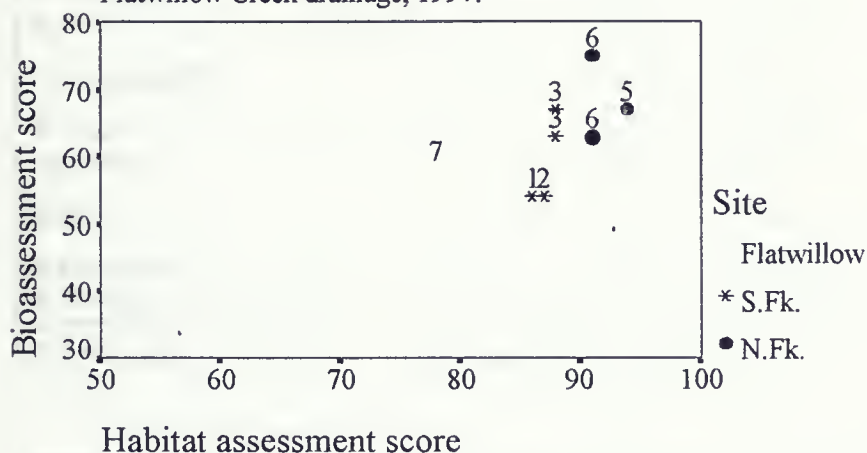


Figure 5 illustrates the relationship between the total habitat scores and total bioassessment scores of the five sites, for each of the ten samples studied. Good correlation between habitat scores and bioassessment scores for most sites reflect the findings of slight impairment in optimal or suboptimal habitats. The position of the markers for sites 1 and 2 on the South

Fork, showing lower bioassessment scores associated with higher habitat scores, correlates well with the community evidence for water quality impacts at these sites.

CONCLUSIONS

- Slight impairment of biotic integrity was indicated at all sites in the Flatwillow Creek drainage. Habitat conditions were judged optimal generally, but the lower Flatwillow Creek site was perceived to be sub-optimal.
- Taxa richness was excellent at five of the seven sites studied, indicating that impacts to benthic habitat are probably mild-to-minimal in the Flatwillow Creek drainage generally. There were moderate reductions in taxa richness at the North Fork site below Havalla's bridge and at the uppermost site on the South Fork.
- In general, the sites sampled on the North Fork of Flatwillow Creek had communities indicating slightly better biotic condition. Differences between the North, South and main forks of Flatwillow Creek were small, but not negligible.
- Seasonal differences in metric scores and taxonomic composition of communities did not

seem to compromise the analysis. Fairly constant community composition between late spring and mid-summer suggest that Flatwillow Creek and its tributaries receive substantial groundwater or spring contributions to flow, or other moderations to seasonal water temperature fluctuations.

- The benthic communities in the North Fork of Flatwillow Creek suggest mild to moderate impairment of water quality by nutrient and/or organic sources. Thermal limitations are also evident, but whether these are natural or anthropogenic is not apparent.
- Macroinvertebrate assemblages in the South Fork of Flatwillow Creek suggest nutrient and/or organic pollution influences, as well as sediment impacts. Warm water temperatures were not documented, but are suggested by the taxonomic composition of the communities at the two lower sites.

TABLES

Table 1. Internal reference values and criteria for assigning scores to metrics based on comparison to an ecoregional reference.					
metric	Montana Valleys and Foothill Prairies Ecoregion reference ¹	Scoring Criteria			
		3	2	1	0
Taxa richness		>28	28-21	21-14	<14
EPT richness		>14	14-13	12-11	<11
Biotic index		<4	4-5	5-6	>6
% dominant taxon		<30	30-40	40-50	>50
%Collector(g+ff)		<60	60-75	75-90	>90
% Scraper +Shredder		>30	30-20	20-10	<10
% EPT		>60	60-45	45-30	<30
% Hydropsych. of Trichop.		<75	75-85	85-95	>95

1. Bukantis, 1997.

Table 2a. Criteria for the assignment of support classifications / standards violation thresholds (from Bukantis, 1997)	
% Comparability to reference	Use support
>75	Full support--standards not violated
25-75	Partial support--moderate impairment--standards violated
<25	Non-support--severe impairment--standards violated
Table 2b. Criteria for the assignment of impairment classifications (from Plafkin et al. 1989).	
% Comparability to reference	Classification
> 83	nonimpaired
54-79	slightly impaired
21-50	moderately impaired
<17	severely impaired

Table 3. Internal reference values and criteria for assigning scores to metrics based on percent comparability to reference values (adapted from McGuire 1995):

metric	Flatwillow Creek system reference 1997 ¹	Scoring Criteria				*
		3	2	1	0	
Taxa richness	41	> 80%	80-60%	60-40%	< 40%	a
EPT richness	18	> 85%	85-70%	70-50%	< 50%	a
Biotic index	3.05	> 90%	90-80%	80-70%	< 70%	b
% dominant taxon	13	> 60%	60-45%	45-30%	< 30%	b
%Collector(g+ff)	57	> 90%	90-80%	80-70%	< 70%	b
% Scraper +Shredder	33	> 80%	80-60%	60-40%	< 40%	a
% EPT	92	> 75%	75-50%	50-25%	< 25%	a
% Hydropsych. of Trichop.	0	< 50%	50-70%	70-90%	> 90%	c
¹ 1997. Internal reference values are the "best" appropriate values among those calculated for the Flatwillow Creek system in 1997. * a = score is ratio of study site to reference x 100. * b = score is ratio of reference to study site x 100. * c = score is based on the actual value, not a percentage of reference.						

Table 4. Metric scores, calculated as percentages of ecoregional reference values, and bioassessments for the Flatwillow Creek System, June and August, 1997.

metric	8/13			8/14			8/14			8/14		
	SITE 1: S.FK.	SITE 2: S.FK.	SITE 3: S.FK.	SITE 1: S.FK.	SITE 2: S.FK.	SITE 3: S.FK.	SITE 1: S.FK.	SITE 2: S.FK.	SITE 3: S.FK.	SITE 1: S.FK.	SITE 2: S.FK.	SITE 3: S.FK.
Taxa richness	2			3			2			3		
EPT richness	1			2			1			2		
Biotic index	3			2			2			2		
% dominant taxon	3			3			3			3		
% Collector (g+ff)	1			1			2			2		
% Scrapers + Shredders	0			1			2			2		
% EPT	1			2			3			1		
% Hydropsychinae of Trichoptera	3			3			3			3		
total score (max = 24)	14			17			18			18		
% reference	58			71			75			75		
classification *	SLI			SLI			SLI			SLI		
use support	PARTIAL			PARTIAL			PARTIAL			PARTIAL		

metric	8/14			6/26			8/14			6/27		
	SITE 4: N.FK.	SITE 5: N.FK.	SITE 6: N.FK.	SITE 4: N.FK.	SITE 5: N.FK.	SITE 6: N.FK.	SITE 4: N.FK.	SITE 5: N.FK.	SITE 6: N.FK.	SITE 4: N.FK.	SITE 5: N.FK.	SITE 6: N.FK.
Taxa richness	3			2			3			3		
EPT richness	2			2			3			3		
Biotic index	1			3			2			3		
% dominant taxon	3			3			3			3		
% Collector (g+ff)	3			2			2			1		
% Scrapers + Shredders	3			2			1			0		
% EPT	2			3			3			2		
% Hydropsychinae of Trichoptera	3			3			3			3		
total score (max = 24)	20			20			20			18		
% reference	83			83			83			75		
classification *	NON			NON			NON			SLI		
use support	FULL			FULL			FULL			PARTIAL		

Table 5. Metric values, percentage of internal reference, and bioassessments for South Fork Flatwillow Creek. August 13 and 14, 1997.

metric	8/13 SITE 1: S.F.K.	8/14 SITE 2: S.F.K.	8/14 SITE 2: S.F.K.	8/14 SITE 3: S.F.K.	8/14 SITE 3: S.F.K.
Taxa richness	28	36	28	31	39
EPT richness	12	14	12	14	17
Biotic index	3.38	4.68	4.90	4.90	5.06
% dominant taxon	17	19	23	13	16
% Collector (g+ff)	81	79	71	65	68
% Scrapers + Shredders	4	11	22	24	16
% EPT	44	57	67	44	56
% Hydropsychinae of Trichoptera	0	50	61	21	65
% of reference					
Taxa richness	68	88	68	76	95
EPT richness	67	78	67	78	94
Biotic index	90	65	62	62	60
% dominant taxon	76	68	57	100	81
% Collector (g+ff)	70	72	80	88	84
% Scrapers + Shredders	12	33	67	73	48
% EPT	48	62	73	48	61
% Hydropsychinae of Trichoptera	0	50	61	21	65
metric score					
Taxa richness	2	3	2	2	3
EPT richness	1	2	1	2	3
Biotic index	2	0	0	0	0
% dominant taxon	3	3	2	3	3
% Collector (g+ff)	1	1	2	2	2
% Scrapers + Shredders	0	0	2	2	1
% EPT	1	2	2	1	2
% Hydropsychinae of Trichoptera	3	2	2	3	2
total score (max = 24)	13	13	13	15	16
% reference	54	54	54	63	67
classification *	SLI	SLI	SLI	SLI	SLI
use support	PARTIAL	PARTIAL	PARTIAL	PARTIAL	PARTIAL

* classifications: (NON) non-impaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impaired.

continued....

Table 5 (cont.) Metric values, percentage of internal reference, and bioassessments for the Flatwillow Creek System, June and August, 1997.

metric	8/14 SITE 4: N.F.K.	6/26 SITE 5: N.F.K.	8/14 SITE 6: N.F.K.	8/14 SITE 6: N.F.K.	6/27 SITE 7: FLTWLW
Taxa richness	41	24	40	35	33
EPT richness	13	14	17	18	11
Biotic index	5.55	3.05	4.15	3.97	3.99
% dominant taxon	28	34	20	24	21
% Collector (g+ff)	57	75	64	77	82
% Scrapers + Shredders	33	20	18	7	9
% EPT	47	92	61	50	79
% Hydropsychinae of Trichoptera	32	8	46	36	48
% of reference					
Taxa richness	100	59	98	85	80
EPT richness	72	78	94	100	61
Biotic index	55	100	73	77	76
% dominant taxon	46	38	65	54	62
% Collector (g+ff)	100	76	89	74	70
% Scrapers + Shredders	100	61	55	21	27
% EPT	51	100	66	54	86
% Hydropsychinae of Trichoptera	32	8	46	36	48
metric score					
Taxa richness	3	1	3	3	2
EPT richness	2	2	3	3	1
Biotic index	0	3	1	1	1
% dominant taxon	2	1	3	2	3
% Collector (g+ff)	3	1	2	1	1
% Scrapers + Shredders	3	2	1	0	0
% EPT	2	3	2	2	3
% Hydropsychinae of Trichoptera	3	3	3	3	3
total score (max = 24)	18	16	18	15	14
%reference	75	67	75	63	58
classification *	SLI	SLI	SLI	SLI	SLI
use support	PARTIAL	PARTIAL	PARTIAL	PARTIAL	PARTIAL

* classifications: (NON) non-impaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impaired.

Table 6. Stream and riparian habitat assessment: the Flatwillow Creek system, June and August, 1997.

Max. possible score	Location:	8/13 SITE 1: S.F.K.	8/14 ¹ SITE 2: S.F.K.	8/14 ¹ SITE 3: S.F.K.	6/26 SITE 5: N.F.K.	8/14 ¹ SITE 6: N.F.K.	6/27 SITE 7: FLTW
10	Parameter						
10	rifle development	10	9	8	9	8.5	7
20	substrate development	9	9.5	8.5	8	9	9
20	embeddedness	16	16	18.5	17	19	15
20	channel alteration	20	20	15.5	20	19	20
20	sediment deposition	16	9	14	16	10	12
20	flow status	20	20	20	20	20	20
10/10	bank stability (right/left)	7/7	9/9	7/10	10/10	14/8.5	6/6
10/10	bank vegetative cover						
10/10	(right/left)	8/8	10/10	9/10	10/10	7/10	9/9
10/10	riparian width (right/left)	7/10	9/9	10/10	10/10	10/10	2/10
160	TOTAL:	138	139.5	140.5	150	145	125
PERCENT OF MAXIMUM:		86	87	88	94	91	78
CONDITION ² :		OPTIMAL	OPTIMAL	OPTIMAL	OPTIMAL	OPTIMAL	SUBOPTIMAL

1. Mean habitat parameter values are given for replicated assessments.

2. Condition categories: Optimal > 81% of maximum score; Sub-optimal 75 - 56%; Marginal 49 - 29%; Poor <23%.

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APPENDIX

Aquatic Macroinvertebrate Data Flatwillow Creek Drainage, Fergus County, Montana

June and August, 1997

Macroinvertebrate Taxonomic Data

SOUTH FORK FLATWILLOW CREEK: Uppermost site

130897 R1

Taxon	#	%	BI ¹	FFG ²
Turbellaria	1	0.30	4	PR
Acari	2	0.61	5	PA
TOTAL: MISC. TAXA	3	0.91		
Acentrella	2	0.61	4	CG
Baetis tricaudatus	48	14.63	4	CG
Dipheter hageni	8	2.44	5	CG
Drunella spinifera	26	7.93	0	PR
Serratella tibialis	13	3.96	2	CG
Paraleptophlebia	11	3.35	1	CG
TOTAL: EPHEMEROPTERA	108	32.93		
Amphinemura	9	2.74	2	SH
Zapada cinctipes	2	0.61	3	SH
Skwala	2	0.61	3	PR
TOTAL: PLECOPTERA	13	3.96		
Psychoglypha	2	0.61	0	CG
Wormaldia	17	5.18	0	CF
Rhyacophila Brunnea Gr.	5	1.52	2	PR
TOTAL: TRICHOPTERA	24	7.32		
Dryopidae	1	0.30	5	SH
Heterolimnius	4	1.22	3	CG
Optioservus	2	0.61	5	SC
TOTAL: COLEOPTERA	7	2.13		
Simulium	31	9.45	5	CF
Stratiomyiidae	1	0.30	7	CG
Dicranota	6	1.83	3	PR
Hexatoma	5	1.52	2	PR
TOTAL: DIPTERA	43	13.11		
Eukiefferiella	43	13.11	8	CG
Micropsectra	12	3.66	4	CG
Orthocladius	15	4.57	6	CG
Pagastia	55	16.77	1	CG
Parametriocnemus	2	0.61	5	CG
Thienemannimyia	1	0.30	5	PR
Tvetenia	2	0.61	5	CG
TOTAL: CHIRONOMIDAE	130	39.63		
GRAND TOTAL	328	100.00		

1. Functional feeding group designations are given in TABLE A.

2. Biotic index scores for individual taxa, as given in Bukacinski, 1997.

Aquatic Macroinvertebrate Data: South Fork Flatwillow Creek: uppermost site.

13 August 1997

Sample: 130897 R1

% of sample used:	20
Subsample size	328
Taxa richness	28
EPT richness	12
Biotic index	3.38
% Dominant taxon	17
% EPT	44
% Collectors (g+f)	81
% Scrapers + Shredders	4
% Hydropsychinae of Trich	0
Metals tolerance index	4.69
Shannon Diversity (log2)	3.88
EPT/Chironomidae	1.12
CTQa	68.52
%Baetidae of Ephemeroptera	54
% Coleoptera	2
% Diptera	13
% Chironomidae	40
% Ephemeroptera	33
% Plecoptera	4
% Trichoptera	7
% multivoltine	44
% univoltine	53
% semivoltine	3

Functional Feeding Grp.	%RA	# taxa
Filterers	15	2
Collector-Gatherers	66	14
Shredders	4	3
Scrapers	1	1
Predators	14	7
Est. total number of organisms	1640	
Est. number collected per foot	78	
Est. number collected per minute	1640	

Macroinvertebrate Taxonomic Data

SOUTH FORK FLATWILLOW CREEK: middle reach

970814 R1.1

Taxon	#	%	BI	FFG
Oligochaeta	1	0.31	10	CG
Sphaeriidae	3	0.92	8	CF
Physella	10	3.06	8	SC
TOTAL: MISC. TAXA	14	4.28		
Baetis tricaudatus	39	11.93	4	CG
Dipheter hageni	5	1.53	5	CG
Drunella spinifera	1	0.31	0	PR
Paraleptophlebia	1	0.31	1	CG
TOTAL: EPHEMEROPTERA	46	14.07		
Zapada cinctipes	8	2.45	3	SH
Hesperoperla pacifica	1	0.31	1	PR
Skwala	5	1.53	3	PR
TOTAL: PLECOPTERA	14	4.28		
Brachycentrus occidentalis	20	6.12	2	CF
Cheumatopsyche	5	1.53	5	CF
Hydropsyche	58	17.74	5	CF
Hydroptila	18	5.50	6	CG
Ochrotrichia	16	4.89	4	PH
Oecetis	3	0.92	8	PR
Wormaldia	6	1.83	0	CF
TOTAL: TRICHOPTERA	126	38.53		
Microcylloepus	1	0.31	5	CG
Heterlimnius	1	0.31	3	CG
Optioservus	18	5.50	5	SC
Zaitzevia	4	1.22	4	CG
TOTAL: COLEOPTERA	24	7.34		
Simulium	63	19.27	5	CF
Dicranota	4	1.22	3	PR
Hexatoma	3	0.92	2	PR
TOTAL: DIPTERA	70	21.41		
Corynoneura	1	0.31	7	CG
Cricotopus	2	0.61	7	CG
Cricotopus Trifascia Gr.	1	0.31	6	CG
Eukiefferiella	3	0.92	8	CG
Eukiefferiella Devonica Gr.	2	0.61	8	CG
Micropsectra	2	0.61	4	CG
Orthocladius	6	1.83	6	CG
Parametriocnemus	8	2.45	5	CG
Polypedilum	4	1.22	6	CG
Rheotanytarsus	1	0.31	6	CF
Thienemanniella	1	0.31	6	CG
Tvetenia	2	0.61	5	CG
TOTAL: CHIRONOMIDAE	33	10.09		
GRAND TOTAL	327	100.00		

Aquatic Macroinvertebrate Data: South Fork Flatwillow Creek: middle reach. 14August 1997

Sample:	970814 R1.1	
% of sample used:	25	
Subsample size	327	
Taxa richness	36	
EPT richness	14	
Biotic index	4.68	
% Dominant taxon	19	
% EPT	57	
% Collectors (g+f)	79	
% Scrapers + Shredders	11	
% Hydropsychinae of Trich	50	
Metals tolerance index	4.31	
Shannon Diversity (log2)	4.01	
EPT/Chironomidae	5.64	
CTQa	82.83	
%Baetidae of Ephemeroptera	96	
% Coleoptera	7	
% Diptera	21	
% Chironomidae	10	
% Ephemeroptera	14	
% Plecoptera	4	
% Trichoptera	39	
% multivoltine	30	
% univoltine	55	
% semivoltine	14	
Functional Feeding Grp.	%RA	# taxa
Filterers	48	7
Collector-Gatherers	31	19
Shredders	2	1
Scrapers	9	2
Predators	5	6
Est. total number of organisms	1308	
Est. number collected per foot	82	
Est. number collected per minute	1308	

Macroinvertebrate Taxonomic Data

SOUTH FORK FLATWILLOW CREEK: middle reach

970814 R1.2

Taxon	#	%	BI	FFG
Nematoda	1	0.35	5	OM
Oligochaeta	3	1.06	10	CG
Sphaeriidae	3	1.06	8	CF
Physella	32	11.35	8	SC
TOTAL: MISC. TAXA	39	13.83		
Baetis tricaudatus	29	10.28	4	CG
Dipheter hageni	3	1.06	5	CG
TOTAL: EPHEMEROPTERA	32	11.35		
Amphinemura	2	0.71	2	SH
Zapada cinctipes	2	0.71	3	SH
Hesperoperla pacifica	1	0.35	1	PR
Skwala	7	2.48	3	PR
TOTAL: PLECOPTERA	12	4.26		
Brachycentrus occidentalis	27	9.57	2	CF
Cheumatopsyche	24	8.51	5	CF
Hydropsyche	65	23.05	5	CF
Hydroptila	8	2.84	6	CG
Oecetis	11	3.90	8	PR
Wormaldia	11	3.90	0	CF
TOTAL: TRICHOPTERA	146	51.77		
Cleptelmis	3	1.06	4	CG
Optioservus	25	8.87	5	SC
TOTAL: COLEOPTERA	28	9.93		
Simulium	11	3.90	5	CF
Dicranota	1	0.35	3	PR
TOTAL: DIPTERA	12	4.26		
Cricotopus Trifascia Gr.	1	0.35	6	CG
Eukiefferiella	1	0.35	8	CG
Eukiefferiella Devonica Gr.	1	0.35	8	CG
Orthocladius	1	0.35	6	CG
Parametriocnemus	6	2.13	5	CG
Polypedilum	1	0.35	6	CG
Rheotanytarsus	1	0.35	6	CF
Thienemannimyia	1	0.35	5	PR
TOTAL: CHIRONOMIDAE	13	4.61		
GRAND TOTAL	282	100.00		

Aquatic Macroinvertebrate Data: South Fork Flatwillow Creek, middle reach. 14August 1997.

Sample:	970814 R.1.2	
% of sample used:	7	
Subsample size	282	
Taxa richness	28	
EPT richness	12	
Biotic index	4.90	
% Dominant taxon	23	
% EPT	67	
% Collectors (g+f)	71	
% Scrapers + Shredders	22	
% Hydropsychinae of Trich	61	
Metals tolerance index	4.23	
Shannon Diversity (log2)	3.73	
EPT/Chironomidae	14.6	
CTQa	80.86	
%Baetidae of Ephemeroptera	100	
% Coleoptera	10	
% Diptera	4	
% Chironomidae	5	
% Ephemeroptera	11	
% Plecoptera	4	
% Trichoptera	52	
% multivoltine	22	
% univoltine	57	
% semivoltine	21	
Functional Feeding Grp.	%RA	# taxa
Filterers	50	7
Collector-Gatherers	20	11
Shredders	1	2
Scrapers	20	2
Predators	7	5
Est. total number of organisms	3816	
Est. number collected per foot	182	
Est. number collected per minute	3816	

Macroinvertebrate Taxonomic Data

SOUTH FORK FLATWILLOW CREEK:

Above mouth

140897 R2.1

Taxon	#	%	BI	FFG
Oligochaeta	5	1.57	10	CG
Sphaeriidae	4	1.25	8	CF
Physella	17	5.33	8	SC
TOTAL: MISC. TAXA	26	8.15		
Ophiogomphus	4	1.25	5	PR
TOTAL: ODONATA	4	1.25		
Acentrella	3	0.94	4	CG
Baetis tricaudatus	38	11.91	4	CG
Dipheter hageni	10	3.13	5	CG
Caenis	4	1.25	7	CG
Paraleptophlebia	1	0.31	1	CG
Tricorythodes minutus	10	3.13	4	CG
TOTAL: EPHEMEROPTERA	66	20.69		
Amphinemura	1	0.31	2	SH
Skwala	10	3.13	3	PR
TOTAL: PLECOPTERA	11	3.45		
Brachycentrus occidentalis	25	7.84	2	CF
Hydropsyche	13	4.08	5	CF
Hydroptila	10	3.13	6	CG
Nectopsyche	5	1.57	2	SH
Oecetis	8	2.51	8	PR
Wormaldia	2	0.63	0	CF
TOTAL: TRICHOPTERA	63	19.75		
Dubiraphia	11	3.45	6	SC
Heterlimnius	3	0.94	3	CG
Optioservus	42	13.17	5	SC
Zaitzevia	10	3.13	4	CG
TOTAL: COLEOPTERA	66	20.69		
Ceratopogonidae	13	4.08	6	PR
Simulium	39	12.23	5	CF
Dicranota	1	0.31	3	PR
Tipula	1	0.31	4	SH
TOTAL: DIPTERA	54	16.93		
Eukiefferiella Devonica Gr.	1	0.31	8	CG
Orthocladius	8	2.51	6	CG
Pagastia	1	0.31	1	CG
Parametriocnemus	14	4.39	5	CG
Rheotanytarsus	5	1.57	6	CF
TOTAL: CHIRONOMIDAE	29	9.09		
GRAND TOTAL	319	100.00		

Aquatic Macroinvertebrate Data: South Fork Flatwillow Creek: above mouth
14 August 1997

Sample: 140897 R2.1

% of sample used:	32
Subsample size	319
Taxa richness	31
EPT richness	14
Biotic index	4.90
% Dominant taxon	13
% EPT	44
% Collectors (g+f)	65
% Scrapers + Shredders	24
% Hydropsychinae of Trich	21
Metals tolerance index	3.66
Shannon Diversity (log2)	4.27
EPT/Chironomidae	4.83
CTQa	80.00
%Baetidae of Ephemeroptera	77
% Coleoptera	21
% Diptera	17
% Chironomidae	9
% Ephemeroptera	21
% Plecoptera	3
% Trichoptera	20
% multivoltine	22
% univoltine	47
% semivoltine	31

Functional Feeding Grp.	%RA	# taxa
Filterers	28	6
Collector-Gatherers	37	14
Shredders	2	3
Scrapers	22	3
Predators	11	5
Est. total number of organisms	997	
Est. number collected per foot	42	
Est. number collected per minute	997	

Macroinvertebrate Taxonomic Data
SOUTH FORK FLATWILLOW CREEK:
Above mouth

140897 R2.2

Taxon	#	%	BI	FFG
Oligochaeta	13	4.13	10	CG
Helobdella	3	0.95	10	PR
Sphaeriidae	1	0.32	8	CF
Physella	17	5.40	8	SC
Acari	3	0.95	5	PA
TOTAL: MISC. TAXA	37	11.75		
Baetis	1	0.32	5	CG
Baetis tricaudatus	24	7.62	4	CG
Dipheter hageni	1	0.32	5	CG
Caenis	1	0.32	7	CG
Nixe	1	0.32	4	SC
Paraleptophlebia	6	1.90	1	CG
Paraleptophlebia bicornuta	1	0.32	2	CG
Tricorythodes minutus	1	0.32	4	CG
TOTAL: EPHEMEROPTERA	36	11.43		
Amphinemura	9	2.86	2	SH
Skwala	19	6.03	3	PR
TOTAL: PLECOPTERA	28	8.89		
Brachycentrus occidentalis	7	2.22	2	CF
Cheumatopsyche	23	7.30	5	CF
Hydropsyche	50	15.87	5	CF
Hydroptila	6	1.90	6	CG
Ochrotrichia	3	0.95	4	PH
Oecetis	15	4.76	8	PR
Wormaldia	8	2.54	0	CF
TOTAL: TRICHOPTERA	112	35.56		
Dytiscidae	1	0.32	5	PR
Optioservus	19	6.03	5	SC
Zaitzevia	1	0.32	4	CG
Brychius	3	0.95	5	SH
TOTAL: COLEOPTERA	24	7.62		
Simulium	37	11.75	5	CF
Tabanidae	1	0.32	6	PR
Dicranota	6	1.90	3	PR
TOTAL: DIPTERA	44	13.97		
Cricotopus Trifascia Gr.	2	0.63	6	CG
Eukiefferiella	1	0.32	8	CG
Eukiefferiella Devonica Gr.	3	0.95	8	CG
Micropsectra	1	0.32	4	CG
Microtendipes	1	0.32	6	CG
Orthocladius	1	0.32	6	CG
Parametriocnemus	11	3.49	5	CG
Polypedilum	3	0.95	6	CG
Rheotanytarsus	8	2.54	6	CF
Tvetenia	3	0.95	5	CG
TOTAL: CHIRONOMIDAE	34	10.79		
GRAND TOTAL	315	100.00		

Aquatic Macroinvertebrate Data: South Fork Flatwillow Creek: above mouth

14 August 1997

Sample: 140897 R2.2

% of sample used:	14
Subsample size	315
Taxa richness	39
EPT richness	17
Biotic index	5.06
% Dominant taxon	16
% EPT	56
% Collectors (g+f)	68
% Scrapers + Shredders	16
% Hydropsychinae of Trich	65
Metals tolerance index	4.03
Shannon Diversity (log2)	4.35
EPT/Chironomidae	5.18
CTQa	83.18
%Baetidae of Ephemeroptera	72
% Coleoptera	8
% Diptera	14
% Chironomidae	11
% Ephemeroptera	11
% Plecoptera	9
% Trichoptera	36
% multivoltine	23
% univoltine	65
% semivoltine	12

Functional Feeding Grp.	%RA	# taxa
Filterers	43	7
Collector-Gatherers	26	19
Shredders	4	2
Scrapers	12	3
Predators	14	6
Est. total number of organisms	2268	
Est. number collected per foot	95	
Est. number collected per minute	2268	

Macroinvertebrate Taxonomic Data

NORTH FORK FLATWILLOW CREEK: above mouth

140897 R3

Taxon	#	%	BI	FFG
Oligochaeta	2	0.65	10	CG
Sphaeriidae	4	1.30	8	CF
Physella	87	28.25	8	SC
Planorbidae	1	0.32	6	SC
TOTAL: MISC. TAXA	94	30.52		
Ophiogomphus	1	0.32	5	PR
TOTAL: ODONATA	1	0.32		
Acentrella	2	0.65	4	CG
Baetis tricaudatus	20	6.49	4	CG
Dipheter hageni	3	0.97	5	CG
Paraleptophlebia	2	0.65	1	CG
Paraleptophlebia bicornuta	11	3.57	2	CG
Tricorythodes minutus	10	3.25	4	CG
TOTAL: EPHEMEROPTERA	48	15.58		
Zapada cinctipes	3	0.97	3	SH
Skwala	19	6.17	3	PR
TOTAL: PLECOPTERA	22	7.14		
Brachycentrus occidentalis	15	4.87	2	CF
Cheumatopsyche	1	0.32	5	CF
Hydropsyche	23	7.47	5	CF
Hydroptila	34	11.04	6	CG
Oecetis	3	0.97	8	PR
TOTAL: TRICHOPTERA	76	24.68		
Dryopidae	1	0.32	5	SH
Heterlimnius	3	0.97	3	CG
Optioservus	10	3.25	5	SC
TOTAL: COLEOPTERA	14	4.55		
Ceratopogonidae	1	0.32	6	PR
Chelifera	1	0.32	5	PR
Simulium	3	0.97	5	CF
Hexatoma	4	1.30	2	PR
Tipula	1	0.32	4	SH
TOTAL: DIPTERA	10	3.25		
Cardiocladius	1	0.32	5	PR
Corynoneura	1	0.32	7	CG
Cricotopus	2	0.65	7	CG
Cricotopus Trifascia Gr.	1	0.32	6	CG
Eukiefferiella Devonica Gr.	4	1.30	8	CG
Microtendipes	1	0.32	6	CG
Orthocladius	3	0.97	6	CG
Pagastia	1	0.32	1	CG
Parametriocnemus	13	4.22	5	CG
Paraphaenocladius	1	0.32	4	CG
Polypedilum	3	0.97	6	CG
Potthastia	2	0.65	2	CG
Rheocricotopus	1	0.32	4	CG
Rheotanytarsus	8	2.60	6	CF
Tvetenia	1	0.32	5	CG
TOTAL: CHIRONOMIDAE	43	13.96		
GRAND TOTAL	308	100.00		

Aquatic Macroinvertebrate Data: North Fork Flatwillow Creek: above mouth.

14August 1997

Sample: 140897 R3

% of sample used:	22
Subsample size	308
Taxa richness	41
EPT richness	13
Biotic index	5.55
% Dominant taxon	28
% EPT	47
% Collectors (g+f)	57
% Scrapers + Shredders	33
% Hydropsychinae of Trich	32
Metals tolerance index	3.89
Shannon Diversity (log2)	4.02
EPT/Chironomidae	3.40
CTQa	88.97
%Baetidae of Ephemeroptera	52
% Coleoptera	5
% Diptera	3
% Chironomidae	14
% Ephemeroptera	16
% Plecoptera	7
% Trichoptera	25
% multivoltine	27
% univoltine	63
% semivoltine	11

Functional Feeding Grp.	%RA	# taxa
Filterers	18	6
Collector-Gatherers	39	22
Shredders	2	3
Scrapers	32	3
Predators	10	7
Est. total number of organisms	1386	
Est. number collected per foot	51	
Est. number collected per minute	1386	

Macroinvertebrate Taxonomic Data

NORTH FORK FLATWILLOW CREEK:
below bridge to Havalla's house

970626 R1.1

Taxon	#	%	BI	FFG
Oligochaeta	1	0.31	10	CG
Sphaeriidae	1	0.31	8	CF
Hydrobiidae	1	0.31	8	SC
TOTAL: MISC. TAXA	3	0.93		
Baetis tricaudatus	109	33.64	4	CG
Dipheter hageni	4	1.23	5	CG
Attenella	55	16.98	2	SC
Ephemerella	31	9.57	1.5	CG
Nixe	6	1.85	4	SC
Paraleptophlebia	3	0.93	1	CG
Choroterpes	1	0.31	2	CG
Tricorythodes minutus	7	2.16	4	CG
TOTAL: EPHEMEROPTERA	216	66.67		
Isoperla	1	0.31	PR	
Skwala	1	0.31	3	PR
TOTAL: PLECOPTERA	2	0.62		
Brachycentrus occidentalis	69	21.30	2	CF
Hydropsyche	6	1.85	5	CF
Hydroptila	2	0.62	6	CG
Wormaldia	3	0.93	0	CF
TOTAL: TRICHOPTERA	80	24.69		
Optioservus	3	0.93	5	SC
TOTAL: COLEOPTERA	3	0.93		
Ceratopogonidae	8	2.47	6	PR
Hexatoma	5	1.54	2	PR
TOTAL: DIPTERA	13	4.01		
Orthocladius	2	0.62	6	CG
Potthastia	1	0.31	2	CG
Rheotanytarsus	3	0.93	6	CF
Tvetenia	1	0.31	5	CG
TOTAL: CHIRONOMIDAE	7	2.16		
GRAND TOTAL	324	100.00		

Aquatic Macroinvertebrate Data: North Fork Flatwillow Creek: below bridge to Havalla's house. 26 June 1997

Sample: 970626 R1.1

% of sample used:	32
Subsample size	324
Taxa richness	24
EPT richness	14
Biotic index	3.05
% Dominant taxon	34
% EPT	92
% Collectors (g+f)	75
% Scrapers + Shredders	20
% Hydropsychinae of Trich	8
Metals tolerance index	3.34
Shannon Diversity (log2)	2.95
EPT/Chironomidae	42.57
CTQa	73.58
%Baetidae of Ephemeroptera	52
% Coleoptera	1
% Diptera	4
% Chironomidae	2
% Ephemeroptera	67
% Plecoptera	1
% Trichoptera	25
% multivoltine	29
% univoltine	49
% semivoltine	23

Functional Feeding Grp.	%RA	# taxa
Filterers	25	5
Collector-Gatherers	50	11
Shredders	0	0
Scrapers	20	4
Predators	5	4
Est. total number of organisms	1012	
Est. number collected per foot	36	
Est. number collected per minute	1012	

Macroinvertebrate Taxonomic Data

NORTH FORK FLATWILLOW CREEK: below Nbar boundary

970814 R4.1

Taxon	#	%	B1	FFG
Oligochaeta	5	1.56	10	CG
Sphaeriidae	1	0.31	8	CF
Physella	24	7.50	8	SC
Planorbidae	1	0.31	6	SC
Acari	1	0.31	5	PA
TOTAL: MISC. TAXA	32	10.00		
Baetis tricaudatus	64	20.00	4	CG
Attenella	3	0.94	2	SC
Drunella spinifera	19	5.94	0	PR
Ephemerella inermis	2	0.63	4	SC
Nixe	1	0.31	4	SC
Paraleptophlebia	2	0.63	1	CG
Paraleptophlebia bicornuta	5	1.56	2	CG
TOTAL: EPHEMEROPTERA	96	30.00		
Chloroperlidae	2	0.63	1	PR
Zapada cinctipes	8	2.50	3	SH
Hesperoperla pacifica	3	0.94	1	PR
Skwala	23	7.19	3	PR
TOTAL: PLECOPTERA	36	11.25		
Brachycentrus occidentalis	27	8.44	2	CF
Hydropsyche	28	8.75	5	CF
Lepidostoma	2	0.63	1	SH
Oecetis	2	0.63	8	PR
Onocosmoecus unicolor	1	0.31	1	OM
Wormaldia	1	0.31	0	CF
TOTAL: TRICHOPTERA	61	19.06		
Microcylloepus	1	0.31	5	CG
Heterlimnius	8	2.50	3	CG
Optioservus	15	4.69	5	SC
Zaitzevia	1	0.31	4	CG
TOTAL: COLEOPTERA	25	7.81		
Chelifera	1	0.31	5	PR
Pericoma	1	0.31	4	CG
Simuliidae	1	0.31	6	CF
Simulium	3	0.94	5	CF
Antocha	2	0.63	3	CG
Hexatoma	6	1.88	2	PR
TOTAL: DIPTERA	14	4.38		
Corynoneura	1	0.31	7	CG
Eukiefferiella	14	4.38	8	CG
Micropsectra	4	1.25	4	CG
Orthocladius	25	7.81	6	CG
Pagastia	8	2.50	1	CG
Parametriocnemus	1	0.31	5	CG
Polypedilum	1	0.31	6	CG
Rheotanytarsus	1	0.31	6	CF
TOTAL: CHIRONOMIDAE	55	17.50		
GRAND TOTAL	319	100.00		

Aquatic Macroinvertebrate Data: North Fork Flatwillow Creek: below Nbar boundary.

14August 1997

Sample: 970814 R4.1

% of sample used:	28
Subsample size	319
Taxa richness	40
EPT richness	17
Biotic index	4.15
% Dominant taxon	20
% EPT	61
% Collectors (g+f)	64
% Scrapers + Shredders	18
% Hydropsychinae of Trich	46
Metals tolerance index	4.08
Shannon Diversity (log2)	4.19
EPT/Chironomidae	3.51
CTQa	70.93
%Baetidae of Ephemeroptera	70
% Coleoptera	8
% Diptera	4
% Chironomidae	17
% Ephemeroptera	30
% Plecoptera	11
% Trichoptera	19
% multivoltine	30
% univoltine	51
% semivoltine	18

Functional Feeding Grp.	%RA	# taxa
Filterers	19	7
Collector-Gatherers	45	16
Shredders	3	2
Scrapers	14	6
Predators	18	7
Est. total number of organisms	1139	
Est. number collected per foot	38	
Est. number collected per minute	1139	

Macroinvertebrate Taxonomic Data

NORTH FORK FLATWILLOW CREEK:

Below Nbar boundary

970814 R4.2

Taxon	#	%	BI	FFG
Oligochaeta	6	1.83	10	CG
Sphaeriidae	1	0.30	8	CF
Physella	4	1.22	8	SC
TOTAL: MISC. TAXA	11	3.35		
Baetis tricaudatus	65	19.82	4	CG
Dipheter hageni	1	0.30	5	CG
Attenella	1	0.30	2	SC
Drunella spinifera	38	11.59	0	PR
Serratella tibialis	2	0.61	2	CG
Nixe	3	0.91	4	SC
Paraleptophlebia	1	0.30	1	CG
Paraleptophlebia bicornuta	11	3.35	2	CG
TOTAL: EPHEMEROPTERA	122	37.20		
Amphinemura	1	0.30	2	SH
Zapada cinctipes	2	0.61	3	SH
Hesperoperla pacifica	1	0.30	1	PR
Skwala	2	0.61	3	PR
TOTAL: PLECOPTERA	6	1.83		
Brachycentrus occidentalis	17	5.18	2	CF
Hydropsyche	13	3.96	5	CF
Lepidostoma	1	0.30	1	SH
Oecetis	2	0.61	8	PR
Onocosmoecus unicolor	1	0.30	1	OM
Wormaldia	2	0.61	0	CF
TOTAL: TRICHOPTERA	36	10.98		
Dytiscidae	1	0.30	5	PR
Optioservus	10	3.05	5	SC
TOTAL: COLEOPTERA	11	3.35		
Ceratopogonidae	1	0.30	6	PR
Simulium	80	24.39	5	CF
Antocha	3	0.91	3	CG
Dicranota	6	1.83	3	PR
TOTAL: DIPTERA	90	27.44		
Eukiefferiella	12	3.66	8	CG
Micropsectra	2	0.61	4	CG
Orthocladius	13	3.96	6	CG
Pagastia	10	3.05	1	CG
Parametriocnemus	3	0.91	5	CG
Rheotanytarsus	9	2.74	6	CF
Thienemanniella	1	0.30	6	CG
Tvetenia	2	0.61	5	CG
TOTAL: CHIRONOMIDAE	52	15.85		
GRAND TOTAL	328	100.00		

Aquatic Macroinvertebrate Data: North Fork Flatwillow Creek: below Nbar boundary.

Sample:	970814 R4.2	
% of sample used:	20	
Subsample size	328	
Taxa richness	35	
EPT richness	18	
Biotic index	3.97	
% Dominant taxon	24	
% EPT	50	
% Collectors (g+f)	77	
% Scrapers + Shredders	7	
% Hydropsychinae of Trich	36	
Metals tolerance index	4.01	
Shannon Diversity (log2)	3.76	
EPT/Chironomidae	3.15	
CTQa	64.80	
%Baetidae of Ephemeroptera	54	
% Coleoptera	3	
% Diptera	27	
% Chironomidae	16	
% Ephemeroptera	37	
% Plecoptera	2	
% Trichoptera	11	
% multivoltine	28	
% univoltine	62	
% semivoltine	10	
Functional Feeding Grp.	%RA	# taxa
Filterers	37	6
Collector-Gatherers	40	14
Shredders	1	3
Scrapers	5	4
Predators	16	7
Est. total number of organisms	1640	
Est. number collected per foot	78	
Est. number collected per minute	1640	

Macroinvertebrate Taxonomic Data

LOWER FLATWILLOW CREEK:

across from test center, near corral, past divertment.

970627 R1.1

Taxon	#	%	BI	FFG
Oligochaeta	3	0.97	10	CG
Sphaeriidae	1	0.32	8	CF
Physidae	1	0.32	8	SC
TOTAL: MISC. TAXA	5	1.62		
Ophiogomphus	7	2.27	5	PR
TOTAL: ODONATA	7	2.27		
Baetis tricaudatus	65	21.04	4	CG
Ephemeridae	19	6.15	4	CG
Nixe	2	0.65	4	SC
Choroterpes	1	0.32	2	CG
Tricorythodes minutus	20	6.47	4	CG
TOTAL: EPHEMEROPTERA	107	34.63		
Ambrysus	7	2.27	3	PR
TOTAL: HEMIPTERA	7	2.27		
Brachycentrus occidentalis	46	14.89	2	CF
Cheumatopsyche	4	1.29	5	CF
Hydropsyche	61	19.74	5	CF
Mayatrichia	20	6.47	1	SC
Oecetis	2	0.65	8	PR
Wormaldia	3	0.97	0	CF
TOTAL: TRICHOPTERA	136	44.01		
Microcylloepus	2	0.65	5	CG
Dubiraphia	1	0.32	6	SC
Optioservus	4	1.29	5	SC
Ordobrevia nubifera	1	0.32	5	CG
TOTAL: COLEOPTERA	8	2.59		
Ceratopogonidae	6	1.94	6	PR
Dolichopodidae	1	0.32	4	PR
Empididae	1	0.32	6	PR
Simulium	1	0.32	5	CF
Hexatoma	2	0.65	2	PR
Tipula	1	0.32	4	SH
TOTAL: DIPTERA	12	3.88		
Orthocladus	15	4.85	6	CG
Pagastia	1	0.32	1	CG
Parametriocnemus	2	0.65	5	CG
Polypedilum	1	0.32	6	CG
Rheotanytarsus	4	1.29	6	CF
Tanytarsus	2	0.65	6	CF
Thienemannimyia	2	0.65	5	PR
TOTAL: CHIRONOMIDAE	27	8.74		
GRAND TOTAL	309	100.00		

Aquatic Macroinvertebrate Data: Lower Flatwillow Creek; across from test center, near corral past divertment. 27June 1997

Sample: 970627 R1.1

% of sample used:	69
Subsample size	309
Taxa richness	33
EPT richness	11
Biotic index	3.99
% Dominant taxon	21
% EPT	79
% Collectors (g+f)	82
% Scrapers + Shredders	9
% Hydropsychinae of Trich	48
Metals tolerance index	3.97
Shannon Diversity (log2)	3.67
EPT/Chironomidae	9.00
CTQa	87.67
%Baetidae of Ephemeroptera	61
% Coleoptera	3
% Diptera	4
% Chironomidae	9
% Ephemeroptera	35
% Plecoptera	0
% Trichoptera	44
% multivoltine	32
% univoltine	44
% semivoltine	23

Functional Feeding Grp.	%RA	# taxa
Filterers	40	8
Collector-Gatherers	42	11
Shredders	<1	1
Scrapers	9	5
Predators	9	8
Est. total number of organisms	445	
Est. number collected per foot	16	
Est. number collected per minute	445	

TABLE A. Functional Feeding Groups

Abbreviation	Description
CF	Collector - filterer
CG	Collector - gatherer
OM	Omnivore
PA	Parasite
PR	Predator
SC	Scraper
UN	Unknown
SH	Shredder

